Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Is the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) present intraperitoneally in patients with coronavirus disease 2019 (COVID-19) infection undergoing emergency operations?

Barbara Seeliger, MD, PhD[a,b,c,*], Guillaume Philouze, MD[c], Ilies Benotmane, MD[d], Didier Mutter, MD, PhD[a,b,c], Patrick Pessaux, MD, PhD[a,b,c]

[a] IHU-Strasbourg, Institute of Image-Guided Surgery, Strasbourg, France
[b] IRCAD, Research Institute against Digestive Cancer, Strasbourg, France
[c] Department of General, Digestive, and Endocrine Surgery, University Hospital of Strasbourg, Strasbourg, France
[d] Department of Virology, University Hospital of Strasbourg, Strasbourg, France

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Introduction

Coronavirus disease 2019 (COVID-19) patients have a high incidence of gastrointestinal (GI) complications including ischemia.[1] Moreover, the pooled presence of ribonucleic acid (RNA) from the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in symptomatic patients was found to be 54% in fecal samples.[2] Little evidence, however, is available on the potential intra-abdominal presence of the virus. Protective measures to minimize staff exposure are recommended by surgical societies worldwide, such as the Society of American Gastrointestinal and Endoscopic Surgeons and the European Association for Endoscopic Surgery.[3] The need to determine whether SARS-CoV-2 is present in abdominal fluids or aerosols originating from carbon dioxide insufflation has been stated. The present study aimed to determine whether the SARS-CoV-2 was present intraoperatively within the peritoneal fluid in a series of COVID-19 patients undergoing emergency abdominal surgery.

Methods

COVID-19 patients undergoing an operative procedure were included in a prospective database within the framework of the CovidSurg international multi-centric cohort study (NCT04323644, French national approval by the CHU Rennes ethical committee on March 20, 2020, #20.25). All patients had pulmonary involvement to some extent (Table) and all but one had symptoms. All patients granted informed consent and were treated with the usual institutional standard of care.

From March 22, 2020 to May 21, 2020, a total of 7 patients with a preoperative diagnosis of COVID-19 infection underwent emergency abdominal surgery for a variety of conditions. Their demographic features and operative details of the study cohort are summarized in the Table. Peritoneal fluid was sampled intraoperatively and analyzed at the virology laboratory of the University of Strasbourg (France). Gene amplification was performed via reverse transcriptase-polymerase chain reaction (RT-PCR), using the inhouse assay, which targets two regions of the SARS-CoV-2 *RNA-dependent RNA polymerase* gene according to the technical guidance of the Institut Pasteur protocol and the World Health Organization.[4] The threshold limit of detection is 10 copies per reaction.

Results

In five patients, the sample quantity was sufficient for RT-PCR analysis. Two patients required immediate operative intervention at admission, recovered well, and were discharged on postoperative day (POD) 4 and POD 3, respectively. Three patients critically ill from their COVID infection developed an acute abdomen during hospitalization and, at the time this report was written, continued treatment in the intensive care unit. The peritoneal samples were obtained

Barbara Seeliger, MD, PhD, and Guillaume Philouze, MD, contributed equally to this study. All authors participated in the study conception and design, data collection, analysis and interpretation, manuscript drafting and revision. All authors critically reviewed and approved the final report.

* Reprint requests: Barbara Seeliger, MD, PhD, IHU-Strasbourg, 1, place de l'Hôpital, 67091 Strasbourg Cedex, France.
E-mail address: barbara.seeliger@ihu-strasbourg.eu (B. Seeliger).

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Table
Study cohort data

Patient	Sex	Age (y)	Admission	Hospital unit	Hospital day of operation	Current status	Preop NP swab	Peritoneal fluid	Preop chest CT, COVID-19 extent	Preop abdominal CT	Pathology	Procedure
1	M	56	13 March 2020	ER/ICU	9	ICU	positive	negative	bilateral	Yes	Small bowel ischemia	Open small bowel resection, second look and double barrel ileostomy on POD2
2	F	71	2 April 2020	ER/OR	1	Home POD 4	positive	negative x2	10%–25% bilateral	Yes	Appendicitis	Laparoscopic appendectomy
3	F	70	20 March 2020	ward/ICU 12.4.	24	ICU	positive	negative x2	25% bilateral, bilateral tuberculosis sequelae (1996/1997)	No*	Sigmoid ischemia	Open rectosigmoid resection (Hartmann)
4	M	44	8 May 2020	ER/OR	1	Home POD 3	negative	negative	<10% bilateral	Yes	hemoperitoneum, liver stab Wound	Open drainage of hemoperitoneum, liver hemostasis
5	F	70	14 April 2020	ER/ICU	25	ICU	positive	negative x2	50%–75% bilateral	Yes	hemopneumoperitoneum	Open drainage of hemoperitoneum, reduction of incarcerated small bowel in lumbar incision†

ER, emergency room; *ICU*, intensive care unit; *OP*, operation; *POD*, postoperative day; *preop*, preoperative.
* Patient 3 presented with rectal bleeding and discharge of mucosa. Rectosigmoidoscopy found ulcerative and ischemic changes, representing an indication for operative intervention without a need for a computed tomography scan.
† Patient 5 had a lumbar incision 3 days earlier to evacuate a left retroperitoneal bleeding/hematoma refractory to arterial embolization. After reduction of the incarcerated bowel, she needed a vacuum laparotomy closure for abdominal compartment syndrome.

both at the beginning and at the end of the operation in three patients and only at the beginning in two patients. Intraperitoneal SARS-CoV-2 infection was not detectable on RT-PCR in any of these patients.

Discussion

The cell membrane protein angiotensin-converting enzyme 2 is key for receptor-mediated cell entry of SARS-CoV-2. Angiotensin-converting enzyme 2 is not only expressed in pneumocytes (type II alveolar cells), but also in the GI tract, notably in ileal and colonic enterocytes.[5] During a COVID-19 infection, the GI tract could be injured directly via virus entry into enterocytes or indirectly via the host inflammatory response.[6] RT-PCR is the gold standard of testing for acute illness, and, in the present study, no intraperitoneal contamination/shedding was observed. Although based on a low number of cases ($n = 5$), the risk of intraperitoneal contamination/shedding of the virus seems less than might be suspected. Systemic spreading of the virus from the lungs to the peritoneal cavity was not detected. Intra-abdominal aerosol production generated from the peritoneal fluid via carbon dioxide insufflation in laparoscopy or from smoke generated by cauterization, potentially spreading the virus to the operating room staff, might be less common than reported for other viruses. Additional research is necessary to elucidate the mechanisms of a COVID-19–associated pathology in the GI tract to identify potential preventive treatment options and optimal protective strategies for operating room personnel.

In conclusion, despite the observation of no intraperitoneal viral RNA in these 5 patients, caution is required to mitigate any potential infection of the operating room team. Currently, no evidence points to a decrease in protective measures whether performing laparoscopy or open abdominal surgery.

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Conflict of interest/Disclosure

The authors have no conflicts of interest to declare.

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